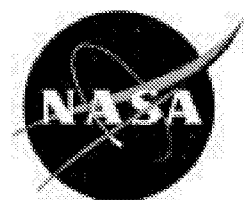


NASA/SP—2000-7011/SUPPL500
May 2000

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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51	Life Sciences (General)	1
	Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see <i>categories 52 through 55</i> .	
52	Aerospace Medicine	7
	Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see <i>53 Behavioral Sciences</i> . For the effects of space on animals and plants see <i>51 Life Sciences</i> .	
53	Behavioral Sciences	12
	Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.	
54	Man/System Technology and Life Support	20
	Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information <i>52 Aerospace Medicine</i> .	
55	Exobiology	27
	Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see <i>52 Aerospace Medicine</i> ; on animals and plants see <i>51 Life Sciences</i> . For psychological and behavioral effects of aerospace environments see <i>53 Behavioral Sciences</i> .	

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Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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AEROSPACE MEDICINE AND BIOLOGY

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51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

20000033840 Columbia Univ., New York, NY USA

Effects of Space Flight-Associated Stimuli on Development of Murine and Medaka Sensory-Motor Systems Final Report, 1 Jan. 1998 - 30 Jun. 1999

Wolgemuth, Debra J., Columbia Univ., USA; [1999]; 5p; In English

Contract(s)/Grant(s): NAG2-1185; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The major goal of these studies was to continue investigations into the influence of altered gravitational fields on the development and function of the vertebrate brain and nervous system. of major focus during the 18-month finding period of this award was the maintenance of the animals used in the experimental mouse and medaka model paradigms. The experiments focused on characterization of stress-sensitive periods in neural development and immediate or delayed effects on gene expression, physiology and behavior. The hypothesis under investigation was that the environment of space will have biologically significant effects on the development and function of the vertebrate nervous system. We have postulated that these effects will be more significant on certain neural compartments, such as the vestibular-motor system, and that these effects will have greater impact at particular stages of embryonic and post-natal development of the animal. Development of the central nervous system is well known for its vulnerability and sensitivity to environmental stimuli, although the effects of gravitational influences are poorly understood. The long-term goals of this research effort, initiated previously and continued in limited capacity during this interim period, were to provide important new information on the effects of altered environments during these critical periods.

Derived from text

Space Flight; Central Nervous System; Vertebrates; Brain; Gravitational Fields; Aerospace Medicine

20000034129 NASA Ames Research Center, Moffett Field, CA USA

Membrane-Based Functions in the Origin of Cellular Life Final Report, 1 Oct. 1995 - 31 Mar. 1999

Chipot, Christophe, Nancy Univ., France; New, Michael H., California Univ., USA; Schweighofer, Karl, NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Wilson, Michael A., NASA Ames Research Center, USA; [1999]; 27p; In English

Contract(s)/Grant(s): NCC2-772; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our objective is to help explain how the earliest ancestors of contemporary cells (protocells) performed their essential functions employing only the molecules available in the protobiological milieu. Our hypothesis is that vesicles, built of amphiphilic, membrane-forming materials, emerged early in protobiological evolution and served as precursors to protocells. We further assume that the cellular functions associated with contemporary membranes, such as capturing and, transducing of energy, signaling, or sequestering organic molecules and ions, evolved in these membrane environments. An alternative hypothesis is that these functions evolved in different environments and were incorporated into membrane-bound structures at some later stage of evolution. We focus on the application of the fundamental principles of physics and chemistry to determine how they apply to the formation of a primitive, functional cell. Rather than attempting to develop specific models for cellular functions and to identify the origin of the molecules which perform these functions, our goal is to define the structural and energetic conditions

that any successful model must fulfill, therefore providing physico-chemical boundaries for these models. We do this by carrying out large-scale, molecular level computer simulations on systems of interest.

Derived from text

Biological Evolution; Membrane Structures; Protobiology; Computerized Simulation; Cytology

20000034235 San Jose State Univ., Dept. of Biological Sciences, CA USA

NASA Animal Enclosure Module Mouse Odor Containment Study for STS-107 September 15, 1999; SJSU Odor Panel Data *Final Report*

Holley, Daniel C., San Jose State Univ., USA; Mele, Gary D., San Jose State Univ., USA; Poffenroth, Mary, San Jose State Univ., USA; Young, Cliff, San Jose State Univ., USA; Feb. 29, 2000; 30p; In English

Contract(s)/Grant(s): NCC2-1136; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experiment #153 by Scott Brady is manifested for shuttle flight STS-107. This evaluation of space flight induced stress and its effects on neuronal plasticity will use 18 six month old C57Bl/6 male mice. A 21 day evaluation study was proposed to determine the length of time groups of 6, 9, or 12 mice could be housed in the Animal Enclosure Module (AEM) without odor breakthrough. This study was performed at NASA-Ames Research Center beginning on September 15, 1999. NASA personnel, were responsible for animal care, maintenance, facilities, hardware, etc. San Jose State personnel performed the odor panel evaluations and data reduction. We used similar procedures and methods for earlier tests evaluating female mice.

Author

Neurophysiology; Odors; Aerospace Medicine; Containment; Space Transportation System Flights; Mice; NASA Programs

20000036512 NASA Marshall Space Flight Center, Huntsville, AL USA

NASA Sponsored Research Involving Crystallization of Biological Materials

Downey, James Patton, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; Crystallization of Biological Macromolecules, 14-19 May 2000, Sandestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An overview of NASA's plans for the performing experiments involving the crystallization of biological materials on the International Space Station (ISS) is presented. In addition, a brief overview of past work is provided as background. Descriptions of flight hardware currently available for use on the ISS are given and projections of future developments are discussed. In addition, experiment selection and funding is described. As of the flight of STS-95, these crystallization projects have proven to be some of the most successful in the history of microgravity research. The NASA Microgravity Research Division alone has flown 185 different proteins, nucleic acids, viruses, and complexes on 43 different missions. 37 of the 185 have resulted, in, diffraction patterns with higher resolution than was obtained in all previous ground based experiments. This occurred despite the fact that an average of only 41 samples per protein were flown. A number of other samples have shown improved signal to noise characteristics, i.e. relative Wilson plots, when compared to the best ground experiments. In addition, a number of experiments investigating the effects of microgravity conditions on the crystallization of biological material have been conducted.

Author

Crystallization; Research and Development; Microgravity; International Space Station

20000037721 NASA Kennedy Space Center, Cocoa Beach, FL USA

Starch Metabolism in Space-Grown Soybean Seedlings *Final Report, 1994-1999*

Guikema, James A., Kansas State Univ., USA; Leach, Jan E., Kansas State Univ., USA; Brown, Christopher, NASA Kennedy Space Center, USA; [1999]; 3p; In English

Contract(s)/Grant(s): NAG10-142; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The focus of this research was the study of sugar metabolism in soybean plants that had been in a clinorotation condition. The scope of activities was broadened greatly after the onset of the award. This broadening added two major research foci: 1) B-PAC: Photosynthetic activity of Brassica rapa; and 2) SOYPAT: The effects of microgravity on the interaction of a fungal root pathogen with soybean. Substantial investment and activity was also focused on the training of the astronaut team to conduct these experiments during orbital spaceflight.

Derived from text

Metabolism; Soybeans; Starches; Sugars; Spaceborne Experiments

20000038342 Universities Space Research Association, Huntsville, AL USA

Over-Expression, Purification and Crystallization of Human Dihydrolipoamide Dehydrogenase

Hong, Y. S., Universities Space Research Association, USA; Ciszak, Ewa, Universities Space Research Association, USA; Patel, Mulchand, State Univ. of New York, USA; [2000]; 1p; In English; 8th International Conference on Crystallization of Biological Macromolecules, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Dehydrolipoamide dehydrogenase (E3; dihydrolipoan-tide:NAD⁺ oxidoreductase, EC 1.8.1.4) is a common catalytic component found in pyruvate dehydrogenase complex, alpha-ketoglutarate dehydrogenase complex, and branched-chain cc-keto acid dehydrogenase complex. E3 is also a component (referred to as L protein) of the glycine cleavage system in bacterial metabolism (2). Active E3 forms a homodimer with four distinctive subdomain structures (FAD binding, NAD⁺ binding, central and interface domains) with non-covalently but tightly bound FAD in the holoenzyme. Deduced amino acids from cloned full-length human E3 gene showed a total of 509 amino acids with a leader sequence (N-terminal 35 amino acids) that is excised (mature form) during transportation of expressed E3 into mitochondria membrane. So far, three-dimensional structure of human E3 has not been reported. Our effort to achieve the elucidation of the X-ray crystal structure of human E3 will be presented. Recombinant pPROEX-1 expression vector (from GIBCO BRL Life Technologies) having the human E3 gene without leader sequence was constructed by Polymerase Chain Reaction (PCR) and subsequent ligation, and cloned in E.coli XL1-Blue by transformation. Since pPROEX-1 vector has an internal His-tag (six histidine peptide) located at the upstream region of a multicloning site, one-step affinity purification of E3 using nickelnitriloacetic acid (Ni-NTA) agarose resin, which has a strong affinity to His-tag, was feasible. Also a seven-amino-acid spacer peptide and a recombinant tobacco etch virus protease recognition site (seven amino acids peptide) found between His-tag and first amino acid of expressed E3 facilitated the cleavage of His-tag from E3 after the affinity purification. by IPTG induction, ca. 15 mg of human E3 (mature form) was obtained from 1L LB culture with overnight incubation at 25C. Over 98% of purity of E3 from one-step Ni-NTA agarose affinity purification was confirmed by SDS-PAGE analysis. For crystallization, E3 samples were prepared with and without His-tag. to minimize the aggregation of E3, apo- and holo- forms of E3s were tested, as well as a mutated E3. Dynamic light scattering measurements revealed that the E3 preparations without His-tag and substrate are highly monodisperse with regard to homodimers. Consequent crystallization trials of this E3 preparation led to single crystals of E3 grown by the vapor diffusion method. Crystals were obtained within a few days from solution containing poly (ethylene glycol) monomethyl ether 5000 as a precipitant. Autoindexing and integration of the X-ray diffraction data showed that E3 crystals belong to an orthorhombic system with unit cell parameters a= 123.1, b= 165.3 and c=214.3A. Further optimization of protein preparation and crystallization experiments for the structural determination will be discussed.

Author

Amino Acids; Crystallization; Enzymes; Peptides; X Ray Diffraction; Protein Crystal Growth; Purification; Biochemistry

20000039369 NASA Marshall Space Flight Center, Huntsville, AL USA

The Effects of pH on the Growth and Aspect Ratio of Chicken Egg White Lysozyme Crystals Prepared in Different Buffers

Gibson, U. J., Dartmouth Coll., USA; Horrell, E. E., Dartmouth Coll., USA; Kou, Y., Dartmouth Coll., USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We have measured the nucleation and aspect ratio of CEWL crystals grown by vapor diffusion in acetate, butyrate, carbonate, succinate, and phosphate buffers in a range of pH spanning the pK(sub a) of these buffers. The nucleation numbers drop off significantly in the vicinity of pK(sub a) for each of the buffers except the phosphate system, in which we used only the pH range around the second titration point(pK2). There is a concomitant increase in the sizes of the crystals. Some typical nucleation number results are shown. These data support and extend other observations. In addition, we have examined changes in aspect ratio which accompany the suppression of nucleation within each buffer system. The length of the face in the [001] direction was measured, and compared to the width of the (110) face in the [110] type directions. We find that while the aspect ratio of the crystals is affected by pH, it is dominated by a correlation with the size of the crystals. Small crystals are longer in the [001] direction than crystals that are larger (higher pH within a buffer system). This relationship is found to hold independent of the choice of buffer. These results are consistent with those of Judge et al, who used a batch process which resulted in uniform sizing of crystals at each pH. In these experiments, we specifically avoid agitating the protein/salt buffer mixture when combining the two. This permits the formation of a range of sizes at a given pH. The results for a .05 M acetate 5% NaCl buffer are also shown. We will discuss these results in light of a growth model.

Author

Crystal Growth; Crystals; Lysozyme; Nucleation; pH; Titration; Buffers (Chemistry)

20000039370 NASA Marshall Space Flight Center, Huntsville, AL USA

Cross-Linking Studies of Lysozyme Nucleation

Forsythe, Elizabeth, NASA Marshall Space Flight Center, USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Tetragonal chicken egg white crystals consist of 4(sub 3) helices running in alternating directions, the helix rows having a two fold symmetry with each other. The unit cell consists of one complete tetrameric turn from each of two adjacent helices (an octamer). PBC analysis indicates that the helix intermolecular bonds are the strongest in the crystal, therefore likely formed first. AFM analysis of the (110) surface shows only complete helices, no half steps or bisected helices being found, while AFM line scans to measure the growth step increments show that they are multiples of the 4(sub 3) helix tetramer dimensions. This supports our thesis that the growth units are in fact multiples of the four molecule 4(sub 3) helix unit, the "average" growth unit size for the (110) face being an octamer (two turns about the helix) and the (101) growth unit averaging about the size of a hexamer. In an effort to better understand the species involved in the crystal nucleation and growth process, we have initiated an experimental program to study the species formed in solution compared to what is found in the crystal through covalent cross-linking studies. These experiments use the heterobifunctional cross-linking agent aminoethyl-4-azidonitroanaline (AEANA). An aliphatic amine at one end is covalently attached to the protein by a carbodiimide-mediated reaction, and a photo reactive group at the other can be used to initiate crosslinking. Modifications to the parent structure can be used to alter the distance between the two reactive groups and thus the cross-linking agents "reach". In practice, the cross-linking agent is first coupled to the asp101 side chain through the amine group. Asp101 lies within the active site cleft, and previous work with fluorescent probes had shown that derivatives at this site still crystallize in the tetragonal space group. This was also found to be the case with the AEANA derivative, which gave red tetragonal crystals. The protein now has a reactive group that can be photoactivated at a specific point in the nucleation or crystal growth process to "capture" protein molecules bound within reach of the crosslinking agent. If those bound protein molecules have a defined geometric relationship with the capturing molecule, such as would be found in a crystal, then the photoreacted cross-linking site should be consistent. Random protein interactions, typical of an amorphous precipitate or interaction, would show a random cross-linking reaction. The results of these and other experiments will be presented.

Author

Crosslinking; Crystal Growth; Crystals; Lysozyme; Nucleation; Proteins; Microstructure

20000039371 NASA Marshall Space Flight Center, Huntsville, AL USA

Size Exclusion Chromatography Studies of the Initial Self-Association Steps of Chicken Egg White Lysozyme Nucleation

Ewing, Felecia, Universities Space Research Association, USA; Donovan, David, Raytheon Co., USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Nucleation is one of the least understood aspects of crystallogenesis. In the case of macromolecule nucleation, this understanding is further hampered by uncertainty over what precisely is being discussed. We define the process of solute self-association (aggregation, oligomerization, interaction, clustering, etc.) whereby n-mers (n is greater than or = 2) having a crystallographic or nascent crystallographic arrangement leading to the critical nucleus reversibly form in the solution, to be part of the nucleation process. This reversible self-association process is a fundamental part of the nucleation process, and occurs as a function of the solute concentration. In the case of chicken egg white lysozyme, a considerable body of experimental evidence leads us to the conclusion that it also forms the crystal growth units. Size exclusion chromatography is a simple and direct method for determining the equilibrium constants for the self-association process. A Pharmacia FPLC system was used to provide accurate solution flow rates. The column, injection valve, and sample loop were all mounted within a temperature-controlled chamber. Chromatographically re-purified lysozyme was first dialyzed against the column equilibration buffer, with injection onto the column after several hours pre-incubation at the running temperature. Preliminary experiments, were carried out using a Toyopearl HW-50F column (1 x 50cm), equilibrated with 0.1 M sodium acetate, 5% sodium chloride, pH 4.6, at 15C. Protein concentrations from 0.1 to 4 mg/ml were employed (C(sub sat) = 1.2 mg/ml). The data from several different protein preparations consistently shows a progressively decreasing elution volume with increasing protein concentration, indicating that reversible self-association is occurring. The dotted line indicates the monomeric lysozyme elution volume. However, lysozyme interacts with the column matrix in these experiments, which complicates data analysis. Accordingly, we are testing silica-based HPLC columns in an effort to eliminate this problem and substantially reduce the column volume and experimental run time. The results and data analysis from these and subsequent experiments will be presented.

Author

Crystal Growth; Lysozyme; Nucleation; Crystallography; Crystals

2000040112 NASA Marshall Space Flight Center, Huntsville, AL USA

Preparation and Characterization of Fluorescent Derivatives of Chicken Egg White Lysozyme

Sumida, John, Universities Space Research Association, USA; Forsythe, Elizabeth, Universities Space Research Association, USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, Sandestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Fluorescence is one of the most versatile and powerful tools for the study of macromolecules. While most proteins are intrinsically fluorescent, working at crystallization concentrations require the use of covalently prepared derivatives added as tracers. This approach requires derivatives that do not markedly affect the crystal packing. We have prepared a number of fluorescent derivatives of chicken egg white lysozyme with probes bound to one of two different sites on the protein molecule. Lucifer yellow, cascade blue, and 5-(2-aminoethyl)aminonaphthalene-1-sulfonic acid (EDANS) have been attached to the side chain carboxyl of asp101 using a carbodiimide coupling procedure. asp101 lies within the active site cleft, and it is believed that the probes are at least partially "buried" within that cleft. Lucifer yellow and MANS probes with iodoacetamide reactive groups have been bound to his15, located on the "back side" of the molecule relative to the active site. The fluorescently labeled protein is readily purified from the starting material by cation exchange chromatography. All the derivatives fluoresce in both the solution and the crystalline states. Fluorescence characterization has focused on determining the bound probe quantum yields, lifetimes, absorption and emission spectra, and quenching by added solutes in comparison to the free probe. No appreciable changes are found in the lifetimes of any of the probes except for cascade blue, where $\tau(\text{sub free}) = 3.52 \text{ ns}$ vrs $\tau(\text{sub bound}) = 2.8 \text{ ns}$. Spectral shifts are found in most cases. Particularly strong quenching upon binding is found in the case of the cascade blue derivative, likely due to probe interactions with the active site cleft. While none of the asp101 bound probes are well quenched by commonly employed solutes, such as potassium and sodium iodide, acrylamide, primuline, the chloride salts of manganese, cesium, and cobalt, trifluoroacetamide, trichloroethanol, and thallium iodide, in those cases where quenching is observed the bound probe is less efficiently quenched relative to the free probe. This indicates that the bound probes are less accessible to the bulk solution, an expected finding for attachment within the active site cleft. Attempts have been made to bind other molecules to these sites, with varying success. Interestingly, all three probes contain one or more sulfonate ((Ar-SO₃)-) groups. We have not been successful in binding analogous probes without sulfate groups such as pyrene, or with derivatized sulfonate groups such as dansyl type probes, analogous to MANS but where the sulfonate group is derivatized, Ar-SO₂-N₂C₂H₇. None of the probes is rigidly bound to the protein, i.e., they all have a probe motion superimposed on that of the protein.

Author

Fluorescence; Lysozyme; Albumins; Biochemistry

2000041376 NASA Johnson Space Center, Houston, TX USA

A Robust Biomarker

Westall, F., NASA Johnson Space Center, USA; Steele, A., NASA Johnson Space Center, USA; Toporski, J., Portsmouth Univ., UK; Walsh, M. M., Louisiana State Univ., USA; Allen, C. C., Lockheed Martin Corp., USA; Guidry, S., Houston Univ., USA; McKay, D. S., NASA Johnson Space Center, USA; Gibson, E. K., NASA Johnson Space Center, USA; Chafetz, H. S., Houston Univ., USA; 2000; 1p; In English; 1st; Astrobiology Science, 3-5 Apr. 2000, Mountain View, CA, USA; Sponsored by NASA Ames Research Center, USA

Contract(s)/Grant(s): RTOP 344-50-92; No Copyright; Avail: Issuing Activity; Abstract Only

Polymers of bacterial origin, either through cell secretion or the degraded product of cell lysis, form isolated mucoidal strands as well as well-developed biofilms on interfaces. Biofilms are structurally and compositionally complex and are readily distinguishable from abiogenic films. These structures range in size from micrometers to decimeters, the latter occurring as the well-known, mineralised biofilms called stromatolites. Compositionally bacterial polymers are greater than 90 % water, with while the majority of the macromolecules forming the framework of the polymers consisting of polysaccharides (with and some nucleic acids and proteins). These macromolecules contain a vast amount of functional groups, such as carboxyls, hydroxyls, and phosphoryls which are implicated in cation-binding. It is the elevated metal-binding capacity which provides the bacterial polymer with structural support and also helps to preserve it for up to 3.5 b.y. in the terrestrial rock record. The macromolecules, thus, can become rapidly mineralised and trapped in a mineral matrix. Through early and late diagenesis (bacterial degradation, burial, heat, pressure and time) they break down, losing the functional groups and, gradually, their hydrogen atoms. The degraded product is known as "kerogen". With further diagenesis and metamorphism, all the hydrogen atoms are lost and the carbonaceous matter becomes graphite. until the remnant carbonaceous material become graphitised. This last sentence reads a bit as if ALL these macromolecules break down and end up as graphite., but since we find 441 this is not true for all of the macromolecules. We have traced fossilised polymer and biofilms in rocks from throughout Earth's history, to rocks as old as the oldest being 3.5 b.y.-old. Furthermore, Time of Flight Secondary Ion Mass Spectrometry has been able to identify individual macromolecules of bacterial origin, the identities of which are still being investigated, in all the samples containing fossil biofilm, including the 3.5

b.y.-old carbonaceous cherts from South Africa and Australia. As a result of the unique compositional, structural and "mineralisable" properties of bacterial polymer and biofilms, we conclude that bacterial polymers and biofilms constitute a robust and reliable biomarker for life on Earth and could be a potential biomarker for extraterrestrial life.

Author

Abiogenesis; Polymers; Bacteria; Geochemistry; Metamorphism (Geology)

20000041378 Sussex Univ., Brighton, UK

[Research Award providing funds for a tracking video camera] *Final Report*

Collett, Thomas, Sussex Univ., UK; 2000; 1p; In English

Contract(s)/Grant(s): NAG2-1260; No Copyright; Avail: Issuing Activity; Abstract Only

The award provided funds for a tracking video camera. The camera has been installed and the system calibrated. It has enabled us to follow in real time the tracks of individual wood ants (*Formica rufa*) within a 3m square arena as they navigate singly in-doors guided by visual cues. to date we have been using the system on two projects. The first is an analysis of the navigational strategies that ants use when guided by an extended landmark (a low wall) to a feeding site. After a brief training period, ants are able to keep a defined distance and angle from the wall, using their memory of the wall's height on the retina as a controlling parameter. by training with walls of one height and length and testing with walls of different heights and lengths, we can show that ants adjust their distance from the wall so as to keep the wall at the height that they learned during training. Thus, their distance from the base of a tall wall is further than it is from the training wall, and the distance is shorter when the wall is low. The stopping point of the trajectory is defined precisely by the angle that the far end of the wall makes with the trajectory. Thus, ants walk further if the wall is extended in length and not so far if the wall is shortened. These experiments represent the first case in which the controlling parameters of an extended trajectory can be defined with some certainty. It raises many questions for future research that we are now pursuing.

Author

Cameras; Trajectories; Wood; Visual Stimuli; Real Time Operation; Insects; Formica

20000043993 NASA Marshall Space Flight Center, Huntsville, AL USA

Developmental Changes in Expression of Beta-Adrenergic Receptors in Cultures of C2C12 Skeletal Muscle Cells

Young, Ronald B., NASA Marshall Space Flight Center, USA; Bridge, K. Y., NASA Marshall Space Flight Center, USA; Vaughn, J. R., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; In Vitro Biology Conference, 11 Jun. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

beta-Adrenergic receptor (bAR) agonists have been reported to modulate growth in several mammalian and avian species, and bAR agonists presumably exert their physiological action on skeletal muscle cells through this receptor. Because of the importance of bAR regulation on muscle protein metabolism in muscle cells, the objectives of this study were to determine the developmental expression pattern of the bAR population in C2C12 skeletal muscle cells, and to analyze changes in both the quantity and isoform expression of the major muscle protein, myosin. The number of bAR in mononucleated C2C12 cells was approximately 8,000 bAR per cell, which is comparable with the population reported in several other nonmuscle cell types. However, the bAR population increased after myoblast fusion to greater than 50,000 bAR per muscle cell equivalent. The reasons for this apparent over-expression of bAR in C2C12 cells is not known. The quantity of myosin also increased after C2C12 myoblast fusion, but the quantity of myosin was less than that reported in primary muscle cell cultures. Finally, at least five different isoforms of myosin heavy chain could be resolved in C2C12 cells, and three of these exhibited either increased or decreased developmental regulation relative to the others. Thus, C2C12 myoblasts undergo developmental regulation of bAR population and myosin heavy chain isoform expression.

Author

Adrenergics; Musculoskeletal System; Cells (Biology); Chemoreceptors; Culture Techniques

20000044666 San Jose State Univ., Dept. of Biological Sciences, CA USA

Circadian Behavioral Study: LED vs Cool White Fluorescent - 0.1, 1, 10, 40, 80 lux, Part 2

Holley, Daniel C., San Jose State Univ., USA; Syrkin, N., San Jose State Univ., USA; Mele, G., San Jose State Univ., USA; Dec. 31, 2000; 30p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Currently, the light source most commonly used in animal habitat lighting is cool white fluorescent (CWF) light. It was the objective of this study to evaluate a novel LED light source for use in animal habitat lighting by comparing its effectiveness to CWF light in producing and maintaining a normal circadian entrainment. The LED and CWF lights had similar spectral power distributions. Sprague-Dawley rats (175-350 g) were kept individually in metabolic cages, under a strict lighting control: 4 days of acclimation at 12:12 LD, 14 days of 12:12 LD, 14 days of 24:0 LD (free-run), and finally 12:12 LD. Food and water were

provided ad libitum. Three behavioral parameters were monitored continuously: gross locomotor activity, drinking, and feeding. Combined mean free run periods (τ) were (mean \pm SEM): 24.6 \pm 0.1 and 24.7 \pm 0.2 at 0.1 lux, 25.5 \pm 0.1 and 25.7 \pm 0.1 at 1.0 lux, 25.3 \pm 0.2 and 25.4 \pm 0.2 at 10 lux, 25.8 \pm 0.1 and 25.9 \pm 0.1 at 40 lux, and 25.9 \pm 0.1 and 25.9 \pm 0.1 at 80 lux, CWF and LED respectively. ANOVA found a significant effect (p is less than 0.05) due to light level, but no difference in τ between rats exposed to constant CWF light and rats exposed to constant LED light. This study has shown that LED light can produce the same entrainment pattern as a conventional CWF light at similar intensities (0.1, 1, 10, 40, and 80 lux). LED light sources may be a suitable replacement for conventional light sources used in animal habitat lighting while providing many mechanical and economical advantages.

Author

Circadian Rhythms; Activity Cycles (Biology); Animals; Habitats

20000044668 San Jose State Univ., Dept. of Biological Sciences, CA USA

Light-Emitting Diodes and Cool White Fluorescent Light Similarly Suppress Pineal Gland Melatonin and Maintain Retinal Function and Morphology in the Rat, Part 1

Holley, Daniel C., San Jose State Univ., USA; Heeke, D., San Jose State Univ., USA; Mele, G., San Jose State Univ., USA; Dec. 31, 1999; 63p; In English

Contract(s)/Grant(s): NCC2-779; HS-R07049; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Currently, the light sources most commonly used in animal habitat lighting are cool white fluorescent or incandescent lamps. We evaluated a novel light-emitting diode (LED) light source for use in animal habitat lighting by comparing its effectiveness to cool white fluorescent light (CWF) in suppressing pineal gland melatonin and maintaining normal retinal physiology and morphology in the rat. Results of pineal melatonin suppression experiments showed equal suppression of pineal melatonin concentrations for LED light and CWF light at five different light illuminances (100, 40, 10, 1 and 0.1 lux). There were no significant differences in melatonin suppression between LED and CWF light when compared to unexposed controls. Retinal physiology was evaluated using electroretinography. Results show no differences in a-wave implicit times and amplitudes or b-wave implicit times and amplitudes between 100-lux LED-exposed rats and 100-lux CWF-exposed rats. Results of retinal histology assessment show no differences in retinal thickness rod outer segment length and number of rod nuclei between rats exposed to 100-lux LED and 100-lux CWF for days. Furthermore, the retinal pigmented epithelium and rod outer segments of all eyes observed were in good condition and of normal thickness. This study indicates that LED light does not cause retinal damage and can suppress pineal melatonin at similar intensities as a conventional CWF light source. These data suggest that LED light sources may be suitable replacements for conventional light sources used in the lighting of rodent vivariums while providing many mechanical and economical advantages.

Author

Pineal Gland; Retarding; Light Emitting Diodes; Luminescence; Light Sources; Illuminating; Fluorescence; Retina; Electroretinography

52

AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20000034097 NASA Langley Research Center, Hampton, VA USA

Cosmic Ray Hits in the Central Nervous System at Solar Maximum

Curtis, S. B., Hutchinson (Fred) Cancer Research Center, USA; Vazquez, M. E., Brookhaven National Lab., USA; Wilson, J. W., NASA Langley Research Center, USA; Atwell, W., Boeing North American, Inc., USA; Kin, M.-H. Y., NASA Langley Research Center, USA; Advances in Space Research; 2000; ISSN 0273-1177; Volume 25, No. 10, pp. 2035-2040; In English; Copyright; Avail: Issuing Activity

It has been suggested that a manned mission to Mars be launched at solar maximum rather than at solar minimum to minimize the radiation exposure to galactic cosmic rays. It is true that the number of hits from highly ionizing particles to critical regions in the brain will be less at solar maximum, and it is of interest to estimate how much less. We present here calculations for several sites within the brain from iron ions ($z = 26$) and from particles with charge, z , greater than or equal to 15. The same shielding configurations and sites in the brain used in an earlier paper for solar minimum are employed so that direct comparison of results between the two solar activity conditions can be made. A simple pressure-vessel wall and an equipment room onboard a spacecraft

are chosen as shielding examples. In the equipment room, typical results for the thalamus are that the probability of any particles with z greater than or equal to 15 and from 2.3 percent to 1.3 percent for iron ions. The extra shielding provided in the equipment room makes little difference in these numbers. We conclude that this decrease in hit frequency (less than a factor of two) does not provide a compelling reason to avoid solar minimum for a manned mission to Mars. This conclusion could be revised, however, if a very small number of hits is found to cause critical malfunction within the brain.

Author

Galactic Cosmic Rays; Solar Activity Effects; Radiation Dosage; Biological Effects; Radiation Effects; Brain

20000034151 Duke Univ., Durham, NC USA

GWI-98 Relationships of Stress Exposures to Health in Gulf War Veterans Annual Report, 1 Oct. 1998 - 30 Sep. 1999

Fairbank, John A.; Oct. 1999; 54p; In English

Contract(s)/Grant(s): DAMD17-98-1-8662

Report No.(s): AD-A374108; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The Relationships of Stress Exposures to Health in Gulf War Veterans study of 10,000 Operation Desert Shield/Storm (ODS/S) veterans (including 5,000 females) uses a national probability-based clustered design in which the mail survey units are a proportional-to-size probability sample of metropolitan areas and county groups from the mailing addresses of veterans who were deployed to the Persian Gulf during ODS/S. The mail survey will provide information on physical health outcomes, exposure to traumatic stressors, psychological functioning, and some basic socioeconomic characteristics. A second systematic sample of over 2,000 male and female veterans will be selected in equal proportions from two groups (Gulf War veterans who reported symptoms of Gulf War Illness and those who did not). This sample will be administered a computer-assisted telephone interview (CATI) that focuses on collecting more in-depth information on premilitary trauma exposure; military-Gulf War trauma and other stress exposures; psychiatric symptoms and disorder, including posttraumatic stress disorder (PTSD), major depression, dysthymia, and substance dependence; social support during the Gulf War and upon homecoming; and socioeconomic outcomes, including labor market functioning and health care service utilization. The mail survey questionnaire has been compiled and formatted for pilot testing and the Desert Shield/Storm (DS/S) and the Comprehensive Clinical Evaluation Program (CCEP) databases are being prepared for selecting the study sample.

DTIC

Health; Stress (Physiology); Stress (Psychology)

20000036548 Weizmann Inst. of Science, Rehovot Israel

Treatment of Retinal Injuries by Low-Energy Laser Final Report, 25 Mar. 1996-24 Mar. 1999

Schwartz, Michal; Apr. 1999; 101p; In English

Contract(s)/Grant(s): DAMD17-96-1-6004

Report No.(s): AD-A374768; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Background and Purpose: Injury to the central nervous system (CNS) in general, and to the visual system (retina or optic nerve) in particular, has a final outcome which is far more severe than the initial damage. If neighboring neurons that escaped the initial insult are to be rescued from eventual degeneration, ways must be found protect them. Adequate neuroprotection presupposes a basic understanding of the way in which the damage spreads, the nature of the mediators of toxicity, the most efficient means of neutralizing these harmful agents or their effects, and ways of making the neural tissue more resistant to the toxicity mediators. Methods: Our choice of model for studying mediators of toxicity and methods of neuroprotection is a partial crush injury of the rat optic nerve. Results: Partial injury of the rat optic nerve leads to a gradual spread of damage from the injured neurons, commencing in either the axons or the cell bodies of adjacent neurons that escaped initial injury. The continuing degeneration is associated with an increase in extracellular glutamate and nitric oxide, and possibly also an increased susceptibility of the spared neurons to the toxicity. We have provided evidence that the immune response, in the form of autoimmune T cells directed against the CNS self antigen myelin basic protein, if suitably boosted, is beneficial in reducing the spread of damage. Conclusion: Partial lesion of the optic nerve results in a self perpetuating and self limiting spread of neuronal damage, which is mediated in part by a toxic increase in physiological compounds, in combination with an increased susceptibility of the affected neurons. Autoimmunity, if suitably controlled, may-be a benign response adapted for the protection and maintenance of the damaged tissue.

DTIC

Retina; Laser Damage; Neurophysiology; Injuries; Nerves

20000036595 NASA Johnson Space Center, Houston, TX USA

Core Temperature Measurement During Submaximal Exercise: Esophageal, Rectal, and Intestinal Temperatures

Lee, Stuart M. C., Wyle Labs., Inc., USA; Williams, W. Jon, Wyle Labs., Inc., USA; Schneider, Suzanne M., NASA Johnson Space Center, USA; April 2000; 56p; In English

Contract(s)/Grant(s): NAS9-18492

Report No.(s): NASA/TP-2000-210133; S-859; NAS 1.60:210133; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this study was to determine if intestinal temperature (T_{in}) might be an acceptable alternative to esophageal (T_{es}) and rectal temperature (T_{rec}) to assess thermoregulation during supine exercise. We hypothesized that T_{in} would have values similar to T_{es} and a response time similar to T_{rec} , but the rate of temperature change across time would not be different between measurement sites. Seven subjects completed a continuous supine protocol of 20 min of rest, 20 min of cycle exercise at 40% peak oxygen consumption (VO_{2pk}), 20 min of cycle exercise at 65% VO_{2pk} , and 20 min of recovery. T_{es} , T_{rec} , and T_{in} were recorded each min throughout the test. Temperatures were not different after 20 min of rest, but T_{rec} was less than the T_{es} and T_{in} at the end of the 40% and 65% VO_{2pk} stages. After 20 min of recovery, T_{es} was less than either T_{rec} or T_{in} , which were not different from each other. Time to threshold for increased temperature from rest was greater for T_{rec} than T_{es} but not different from T_{in} . Time to reach peak temperature was greater for T_{in} and T_{rec} than T_{es} . Similarly, time to a decrease in temperature after exercise was greater for T_{rec} than T_{es} , but not different from T_{in} . The rate of temperature change from threshold to the end of the 40% VO_{2pk} stage was not different between measurement sites. However, the rate of change during recovery was more negative for T_{es} than T_{in} and T_{rec} , which were different from each other. Measurement of T_{in} may be an acceptable alternative to T_{es} and T_{rec} with an understanding of its limitations.

Author

Temperature Measurement; Body Temperature; Physical Exercise

20000037774 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Physiological Performance of Soldiers Conducting Long Range Surveillance and Reconnaissance in Hot, Dry Environments

Lau, Wai-Man, Defence Science and Technology Organisation, Australia; Roberts, Warren, Defence Science and Technology Organisation, Australia; Forbes-Ewan, Chris, Defence Science and Technology Organisation, Australia; Nov. 1999; 40p; In English

Report No.(s): AD-A372886; DSTO-TR-0894; DODA-AR-011-127; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A study was conducted to investigate the physiological performance of soldiers undertaking long range reconnaissance and surveillance activities in the Pilbara region, WA. The results indicated that soldiers experienced very low levels of heat strain during the transport and the setting up of the observation post phases. The heat strain increased to moderate levels while the subjects were conducting a route march in the afternoon. None of the thermal strain indicators (mean core temperature, average heart rate and average area weighted mean skin temperature) exceeded the level considered to indicate moderate heat strain by most civilian OH&S practitioners. The work load on the route march was approximately 50% of the peak metabolic rate, suggesting that this activity was sustainable provided that the environmental heat stress remained moderate. The sweating rate of the soldiers was generally low, with over 90% of the fluid loss attributable to evaporative cooling. There was also evidence that some soldiers experienced hypohydration while one subject appeared hyperhydrated. Based on the outcomes of the Soldier Combat Systems Enhancement Studies and the guidance from DOHSMAN, it is recommended that soldiers undertaking arduous activities should have a minimum fluid intake of 1.5 L.h⁻¹ and that an hourly cycle of 30 min work/30 min rest should be introduced if the Wet Bulb Globe Temperature (WBGT) reaches or exceeds 28°C. Caution must be exercised in interpreting the results as the weather conditions at the time of the study were influenced by a low pressure system. Consequently, the study was carried out under conditions far less stressful than normally experienced in this region. It is recommended that a repeat of the study is necessary to ascertain the true levels of heat strain soldiers would experience under typical hot and climatic conditions.

DTIC

Heat Tolerance; Human Performance; Physiological Effects; Workloads (Psychophysiology); Human Tolerances

20000038205 NASA Marshall Space Flight Center, Huntsville, AL USA

A Review of Electrical Impedance Spectrometry Methods for Parametric Estimation of Physiologic Fluid Volumes *Final Report*

Dewberry, B., NASA Marshall Space Flight Center, USA; January 2000; 38p; In English

Contract(s)/Grant(s): Proj. 96-03

Report No.(s): NASA/TM-2000-210200; M-978; NAS 1.15:210200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Electrical impedance spectrometry involves measurement of the complex resistance of a load at multiple frequencies. With this information in the form of impedance magnitude and phase, or resistance and reactance, basic structure or function of the load can be estimated. The "load" targeted for measurement and estimation in this study consisted of the water-bearing tissues of the human calf. It was proposed and verified that by measuring the electrical impedance of the human calf and fitting this data to a model of fluid compartments, the lumped-model volume of intracellular and extracellular spaces could be estimated, by performing this estimation over time, the volume dynamics during application of stimuli which affect the direction of gravity can be viewed. The resulting data can form a basis for further modeling and verification of cardiovascular and compartmental modeling of fluid reactions to microgravity as well as countermeasures to the headward shift of fluid during head-down tilt or spaceflight.

Author

Impedance Measurement; Spectrometers; Electrical Impedance; Physiological Responses; Microgravity; Cardiovascular System

20000038225 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 496

January 2000; 35p; In English

Report No.(s): NASA/SP-2000-7011/SUPPL496; NAS 1.21:7011/SUPPL496; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP#2000-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes#subject and author are included after the abstract section.

Author

Aerospace Medicine; Exobiology; Life Support Systems; Physiological Effects; Interplanetary Space

20000038226 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography With Indexes, Supplement 497

February 2000; 49p; In English

Report No.(s): NASA/SP-20000-7011/SUPPL497; NAS 1.21:7011/SUPPL 497; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP#2000-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention.

Author

Bibliographies; Indexes (Documentation); Aerospace Medicine; Exobiology

20000038227 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography With Indexes, Supplement 499

April 2000; 99p; In English

Report No.(s): NASA/SP-2000-7011/SUPPL499; NAS 1.21:7011/SUPPL499; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP#1999-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes-subject and author are included after the abstract section.

Derived from text

Aerospace Medicine; Exobiology; Life Support Systems; Physiological Effects; Pharmacology

20000038228 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 498

March 2000; 141p; In English

Report No.(s): NASA/SP-1999-7011/SUPPL498; NAS 1.21:7011/SUPPL498; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP-1999-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.

Author

Aerospace Medicine; Bibliographies; Exobiology; Indexes (Documentation)

20000039414 NASA Johnson Space Center, Houston, TX USA

A Pilot Study for Applying an Extravehicular Activity Exercise Prebreathe Protocol to the International Space Station
Woodruff, Kristin K., Wyle Labs., Inc., USA; Johnson, Anyika N., National Space Biomedical Research Inst., USA; Lee, Stuart M. C., Wyle Labs., Inc., USA; Gernhardt, Michael, NASA Johnson Space Center, USA; Schneider, Suzanne M., NASA Johnson Space Center, USA; Foster, Philip P., Baylor Coll. of Medicine, USA; April 2000; 42p; In English

Report No.(s): NASA/TM-2000-210132; S-858; NAS 1.15:210132; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Decompression sickness (DCS) is a serious risk to astronauts performing extravehicular activity (EVA). To reduce this risk, the addition of ten minutes of moderate exercise (75% VO₂pk) during prebreathe has been shown to decrease the total prebreathe time from 4 to 2 hours and to decrease the incidence of DCS. The overall purpose of this pilot study was to develop an exercise protocol using flight hardware and an in-flight physical fitness cycle test to perform prebreathe exercise before an EVA. Eleven subjects volunteered to participate in this study. The first objective of this study was to compare the steady-state heart rate (HR) and oxygen consumption (VO₂) from a submaximal arm and leg exercise (ALE) session with those predicted from a maximal ALE test. The second objective was to compare the steady-state HR and VO₂ from a submaximal elastic tube and leg exercise (TLE) session with those predicted from the maximal ALE test. The third objective involved a comparison of the maximal ALE test with a maximal leg-only (LE) test to conform to the in-flight fitness assessment test. The 75% VO₂pk target HR from the LE test was significantly less than the target HR from the ALE test. Prescribing exercise using data from the maximal ALE test resulted in the measured submaximal values being higher than predicted VO₂ and HR. The results of this pilot study suggest that elastic tubing is valid during EVA prebreathe as a method of arm exercise with the flight leg ergometer and it is recommended that prebreathe countermeasure exercise protocol incorporate this method.

Author

Astronauts; Extravehicular Activity; International Space Station; Physical Exercise; Decompression Sickness; Oxygen Breathing

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20000033842 Old Dominion Univ., Dept. of Psychology, Norfolk, VA USA
Preliminary Analysis of Photoreading Final Report, Period ending 30 Sep. 1999
 McNamara, Danielle S., Old Dominion Univ., USA; January 2000; 28p; In English
 Contract(s)/Grant(s): NAG2-1319

Report No.(s): ODURF-193021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project was to provide a preliminary analysis of a reading strategy called PhotoReading. PhotoReading is a technique developed by Paul Scheele that claims to increase reading rate to 25,000 words per minute (Scheele, 1993). PhotoReading itself involves entering a "relaxed state" and looking at, but not reading, each page of a text for a brief moment (about 1 to 2 seconds). While this technique has received attention in the popular press, there had been no objective examinations of the technique's validity. To examine the effectiveness of PhotoReading, the principal investigator (i.e., trainee) participated in a PhotoReading workshop to learn the technique. Parallel versions of two standardized and three experimenter-created reading comprehension tests were administered to the trainee and an expert user of the PhotoReading technique to compare the use of normal reading strategies and the PhotoReading technique by both readers. The results for all measures yielded no benefits of using the PhotoReading technique. The extremely rapid reading rates claimed by PhotoReaders were not observed; indeed, the reading rates were generally comparable to those for normal reading. Moreover, the PhotoReading expert generally showed an increase in reading time when using the PhotoReading technique in comparison to when using normal reading strategies to process text. This increase in reading time when PhotoReading was accompanied by a decrease in text comprehension.

Author

Reading; Character Recognition; Readers; Standards

20000033997 Georgia State Univ., Sonny Carter Life Sciences Lab., Atlanta, GA USA
Behavior and Performance Project Final Report

Washburn, David A., Georgia State Univ., USA; Rumbaugh, Duane M., Georgia State Univ., USA; Shlyk, Galina, Institute for Biomedical Problems, Russia; Vassilieva, Oxana, Institute for Higher Nervous Activity, Russia; Richardson, W. Kirk, Georgia State Univ., USA; April 1998; 35p; In English

Contract(s)/Grant(s): NAG2-438; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Behavior is an overt manifestation of underlying biology. As such, alterations in biological systems that result from spaceflight would be expected to evidence themselves in subtle or even pronounced changes in the behavior of that organism. These alterations in visible behavior may then indicate or even be diagnostic of alterations in the physical well-being of humans and other animals as they adapt to space environments or readapt to Earth--alterations that might not otherwise be detected without relatively invasive and frequently expensive procedures. Moreover, behavior and performance constitute the central standard for evaluating the mission success of spaceflight ventures. The success or failure of any excursion into space is primarily indexed by the ability of astronauts and cosmonauts to perform the tasks and experiments of any particular mission, to land a re-entry vehicle after extended exposure to microgravity (as with the space shuttle), or to make time-critical and life-saving repairs or other decisions while in orbit (as with the recent Mir events). Thus, understanding the effects spaceflight on behavior and performance is inherently important, in addition to those insights that behavior can provide about the physiological consequences of space adaptation.

Derived from text

Aerospace Medicine; Space Flight; Psychomotor Performance; Human Behavior

20000034019 Mississippi State Univ., Dept. of Industrial Engineering, Mississippi State, MS USA
Situation Awareness and Levels of Automation Final Report, 1 Jan. - 31 Dec. 1999

Kaber, David B., Mississippi State Univ., USA; [1999]; 8p; In English

Contract(s)/Grant(s): NCC1-330; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the first year of this project, a taxonomy of theoretical levels of automation (LOAs) was applied to the advanced commercial aircraft by categorizing actual modes of McDonald Douglas MD-11 autoflight system operation in terms of the taxonomy. As well, high LOAs included in the taxonomy (e.g., supervisory control) were modeled in the context of MD-11 autoflight systems through development of a virtual flight simulator. The flight simulator was an integration of a re-configurable simulator developed by the Georgia Institute Technology and new software prototypes of autoflight system modules found in the MD-11 cockpit. In addition to this work, a version of the Situation Awareness Global Assessment Technique (SAGAT) was

developed for application to commercial piloting tasks. A software package was developed to deliver the SAGAT and was integrated with the virtual flight simulator.

Author

Flight Simulators; MD 11 Aircraft; Cockpits; Taxonomy

20000034053 Army Aeromedical Research Lab., Fort Rucker, AL USA

The Effects of Sleep Deprivation on Spatial Disorientation Final Report

LeDuc, Patricia A.; Riley, Dean; Hoffman, Siobban M.; Brock, Mary E.; Norman, David; Dec. 1999; 35p; In English

Contract(s)/Grant(s): Proj-301611011B91C

Report No.(s): AD-A372369; USAARL-2000-09; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Spatial disorientation is an inaccurate impression of one's position in space with respect to the earth's surface. As sleep loss is known to produce visual disturbances, this study was designed to investigate the effects of fatigue on aviator response to in-flight, disorienting events. Eight UH-60 rated aviators served as volunteer subjects. The subjects reported to the Laboratory at 1700 on Monday for in processing and baseline testing, retired at 2300, and awoke at 0700 on Tuesday. Throughout the day, aviators repeated one 6-hour practice test block three times. Each block included a 1-hour UH-60 simulator flight, objective and subjective measures of alertness, and several cognitive tests. To control for order effects, half of the subjects remained awake from 0700 Tue. to 2300 Wed. and were exposed to the disorienting events for the first time when they were sleep deprived. The other half of the subjects remained awake from 0700 Wed. to 2300 Thu. and saw the events first when they were fully rested. Analyses showed that nearly all measures of performance, to include mood, alertness, cognition, spatial orientation, postural stability, flight accuracy, and recovery from in-flight disorientation, were detrimentally impacted by fatigue. Aviators also reported a significant increase in oculomotor disturbances following fatigued simulator flights. New methods are being developed to assess the impact of visual disturbances on aviator performance during periods of extended operations.

DTIC

Sleep Deprivation; Disorientation

20000034852 Civil Aeromedical Inst., Oklahoma City, OK USA

The Effects of Previous Computer Experience on Air Traffic-Selection and Training (AT-SAT) Test Performance Final Report

Heil, Michael C., Civil Aeromedical Inst., USA; Agnew, Brandy O., Civil Aeromedical Inst., USA; April 2000; 22p; In English
Report No.(s): DOT/FAA/AM-00/12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many tests that have traditionally been administered in paper-and-pencil format are now administered on a computer workstation. One disadvantage of computer administered tests, however, is the inadvertent measurement of extraneous abilities related to prior experience with a computer keyboard or mouse. Surprisingly, there has been little written in the scientific literature about the use of computers in the selection process by organizations. The current study examines the relationship between computer experience and test performance using a computerized selection test. Specifically, some computerized tests, often referred to as "page-turner" tests, present items that have been adapted to the computer and require the examinee to use the board to select a response to the questions, which are presented one at a time. Another type of test is that which takes the form of dynamic virtual scenarios, work samples, or simulations. These may resemble a video or computer game and often require extensive use of both a mouse and a keyboard. The two main objectives of this study are: to determine if examinees with more computer experience perform better than examinees with less computer experience, and to determine if the relationship between computer experience and computerized test performance remains consistent, regardless of the type of test being presented in the computerized format. A total of 96 people between the ages of 18 and 30 participated in the study. Computer experience was measured using the Computer Use and Experience Questionnaire. The personnel selection test used was the Air Traffic-Selection and Training (AT-SAT) test. The relationship between computer experience and performance on the computerized selection test was investigated using Pearson's product-moment correlations and hierarchical multiple regression. MANOVA and t-tests were also used to identify group differences on the dependent variables. Education was most predictive of AT-SAT performance, and people with more computer experience received higher composite AT-SAT scores. Future studies should explore the extent to which computer experience adds incremental validity over a selection test in predicting job performance, as well as investigate how training may change the relationship between computer experience and test performance so that the effect on personnel decision-making is minimized.

Author

Air Traffic; Air Traffic Control; Personnel Selection; Performance Prediction; Decision Making

20000037705 National Defence Research Establishment, Sundbyberg, Sweden

Models of Pilot Performance for Systems and Mission Evaluation: Psychological and Psychophysiological Aspects Interim Report, May 1997-Mar 1999

Svensson, Erland, National Defence Research Establishment, Sweden; Angelborg-Thanderz, Maud, National Defence Research Establishment, Sweden; Wilson, Glenn F., Air Force Research Lab., USA; Aug. 1999; 57p; In English

Contract(s)/Grant(s): F41624-94-D-6000; AF Proj. 7184

Report No.(s): AD-A374852; AFRL-HE-WP-TR-1999-0215; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The purpose of this study was to analyze the effects of mission complexity and information load on Pilot Mental Workload (PMWL), Situational Cognizance (SC), and Operative Effectiveness (OE) or operative performance. Previous assessment of operative performance or effectiveness has been developed with task analyses using psychological indices constructed with factor analysis. Generally, PMWL is affected by mission complexity and PMWL affects different aspects of Pilot Performance (PP). The specific purposes were to (1) validate psychological, psychophysiological, and performance based measures of PMWL, SC, and OE, (2) develop models of pilot performance for systems and mission evaluation, (3) compare real and simulated missions, and (4) discuss the application of these results to the systematic evaluation of systems and missions with the pilot in the loop. In the first phase, 20 fighter pilots performed 150 flight missions. In the second phase, 15 pilots performed 40 simulated missions. Questionnaires were used to tap mission complexity, information load, mental workload, mental capacity, motivation, situational cognizance, and performance. Additionally, during the simulated missions eye movements, heart and blink rates were obtained. From the flight and simulation data, the model analyses showed that mission complexity affects different aspects of information processing and mental workload and that these aspects, in their turn, affect situational cognizance and pilot performance. Significant relationships were found between heart rate, workload ratings, mental capacity, operative performance, and motivation. Heart rate and eye fixation rates increased, and blink rate decreased with increasing task complexity. A combination of these dynamic measures and the psychological indices form a reliable and valid technique for systems and mission evaluation. DTIC

Psychophysiology; Pilot Performance; Workloads (Psychophysiology); Factor Analysis

20000038216 Institute for Human Factors TNO, Soesterberg, Netherlands

Guidelines Supporting the Analysis of Team Tasks and The Design of Team Training Scenarios Interim Report Richtlijnen ter Ondersteuning van het Analyseren van Teamtaken en het Ontwerpen van Teamtrainingsscenario's

vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Feb. 22, 1999; 106p; In English

Contract(s)/Grant(s): B98-052; TNO Proj. 730.2

Report No.(s): TD99-0018; TM-99-B002; Copyright; Avail: Issuing Activity

Recent research (Van Berlo, 1996, 1997a) shows that, within the military of the Netherlands, there is a need for support with respect to developing team training systems. Important bottlenecks relate to, amongst others, conducting a team task analysis (required for specifying the instructional objectives), and, based on the instructional objectives, designing effective team training scenarios. Based on: (1) a model of team performance, (2) expertise in the field of instructional design, and (3) instructional and psychological principles of training teams, models and guidelines have been developed supporting the analysis of team tasks and the design of team training scenarios. These models and guidelines are profoundly discussed in this report. In the last chapter the direction of further research is described: this will primarily be aimed at the experimental validation of the quality and applicability of the guidelines.

Author

Research; Education; Performance Prediction; Design Analysis

20000038218 Institute for Human Factors TNO, Soesterberg, Netherlands

The Use of IETMs in Training Final Report Het Gebruik van IETMs in Opleiding en Training

Barnard, Y. F., Institute for Human Factors TNO, Netherlands; Riemersma, J. B. J., Institute for Human Factors TNO, Netherlands; Feb. 18, 1999; 183p; In English; Original contains color illustrations

Contract(s)/Grant(s): A96/KLu/344; A95/KLU/823; TNO Proj. 730.1

Report No.(s): TD98-0289; TM-98-A074; Copyright; Avail: Issuing Activity

In this study, the state-of-the-art concerning IETMs and training is described. This shows promising opportunities to integrate IETMs in existing and innovative training environments. These opportunities have been partly explored with regard to re-use of IETM underlying data-bases in preparing classroom presentations and syllabi and with regard to the design of problem-based assignments as an innovative extension of current practices. All explored applications have been demonstrated by building prototypes, using only COTS software. To further enhance the future re-use of IETM data for training purposes, the existing

mark-up languages have to be enriched with educational terms. A first proposal for such an ontology is presented. Further work along the same lines is pursued in a larger, European Esprit project.

Author

Research; Procedures; Manuals

20000038769 Institute for Human Factors TNO, Soesterberg, Netherlands

Innovation of Maintenance Training at the Naval Air Training Centre on the Basis of the Method Structured Troubleshooting: Task- and Training Analysis Interim Report Innovatie van Functie-Opleidingen van de Marine Luchtvaartschool/Opleidingen Valkenburg op Basis van de Methode GSZ: Taak- en Opleidingsanalyse

Schaafstal, A. M., Institute for Human Factors TNO, Netherlands; Bots, M. J., Institute for Human Factors TNO, Netherlands; Feb. 23, 1999; 40p; In Dutch

Contract(s)/Grant(s): A98/KM/338; TNO Proj. 730.2

Report No.(s): TD-99-0022; TM-99-A019; Copyright; Avail: Issuing Activity

Within the Naval Air Training School there is a very strong interest in the continuous improvement of training. As part of this interest, there is a need to start with the implementation of computer-based training. The TNO Human Factors Research Institute has been asked to support this process of innovation among others, by introducing the method "Structured Troubleshooting". As an example for the innovation, the function course for maintaining the Automatic Flight Control System of the P3-C Orion has been chosen. A cognitive task analysis and training analysis have been carried out on the basis of which strengths and weaknesses with respect to knowledge and skill were determined, while taking into account that after the theoretical training, there is still a practical period in the Maintenance Department to come. It is concluded that the Naval Air Training School is doing a fine job in establishing a firm factual knowledge base. However, the training of system knowledge needs more attention. Trainees, who just finished their theoretical course at the Naval Air Training School still have problems in troubleshooting. They lack a systematic approach, have difficulties in the application of system knowledge, and also taking measurements is not a flawless process. In the improvement of the whole training process, and as a start, the improvement of the preparation of the theoretical course at the Naval Air Training School for the practical period afterwards, there are various possibilities for the use of Computer-Based Training. They will be elaborated upon, resulting in a demonstration-prototype, in the next part of the project.

Author

Flight Training; Maintenance Training; Training Analysis; Personnel Development; Automatic Flight Control; Computer Techniques

20000038773 Institute for Human Factors TNO, Soesterberg, Netherlands

Team Training for Team Performance: Models of Team Task Performance Interim Report Teamtraining voor Teamfunctioneren: Modellen van Teamfunctioneren

vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Dec. 09, 1998; 33p; In English

Contract(s)/Grant(s): B98-052; TNO Proj. 730.2

Report No.(s): TD-98-0279; TM-98-8014; Copyright; Avail: Issuing Activity

The objective of any training system is to change the competencies of the trainees so they can perform their tasks in the operational environment more effectively and efficiently. The conditions for the instructional systems development process with respect to team training are the tasks performed by the team, the way these tasks are performed, the knowledge, skills and attitudes that are required, the kind of environments in which the tasks are performed, the conditions of adequate task performance, the tools and equipments to be used, and especially the relationships and interdependencies between the tasks of the team members. It is important to know what constitutes good team task performance, and which factors influence team task performance. Without this knowledge designing adequate team training is hardly possible, resulting in ineffective operational performance. In this report several models and dimensions of team task performance and team leader effectiveness will be described. It is not the purpose to present a detailed discussion of all factors affecting team task performance, or all models encompassing these factors; such overviews can be found elsewhere. Rather, the reader will gain insight in these factors that should be accounted for in team training system design. In this report a final model is presented that can be regarded as a summary of the described models. This summarizing model is very broad and encompasses many factors influencing team performance. Because of the complexity of team performance, it is important to note that training is not the sole contributor to enhance team effectiveness. But carefully identifying and analysing the variables affecting team performance, and taking into account these factors in the process of training system design, will have a positive effect on the effectiveness of the team training.

Author

Education; Human Performance; Performance Prediction; Teams

20000039424 Institute for Human Factors TNO, Soesterberg, Netherlands

The Functionality of Training Support Packages Supporting Tactical Team Training in TACTIS *Interim Report De Functionaliteit van Training Support Packages ten Behoeve van Tactische Eenheidstrainingen met Behulp van TACTIS*

vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Riemersma, J. B. J., Institute for Human Factors TNO, Netherlands; Mar. 11, 1999; 28p; In Dutch

Contract(s)/Grant(s): A97/KL/330; TNO Proj. 730.2

Report No.(s): TD-99-0025; TM-99-A022; Copyright; Avail: Issuing Activity

TACTIS will be a virtual distributed training environment for executing combat actions by mechanized manoeuvre units (up to the company level) and for training individual crew members. During the organization, preparation, execution and evaluation of tactical team training in TACTIS, the training staff and to be trained team/unit are offered support in the form of Training Support Packages (TSP's). This report describes the tasks of the various users of a TSP and, based on this description, and a first design concerning the functionality of a Training Support Package. However, it is very important to definitely define the size of the training staff, as well as the tasks the members have to perform: the more various tasks have to be performed by one member, the more support should be offered. It is further recommended to develop different versions of a TSP for each category of users in order to provide for optimal support of the specific tasks that have to be performed.

Author

Education; Tactics; Military Operations

20000039426 Institute for Human Factors TNO, Soesterberg, Netherlands

Effects of Three-Dimensional Auditory Information on Spatial Situation Awareness of Pilots *Final Report De rol van stereo-zien bij het besturen van pantservoertuigen in ruw terrein*

Oving, A. B., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Dec. 14, 1998; 44p; In English; Original contains color illustrations

Contract(s)/Grant(s): A97/KLu/308; TNO Proj. 788.1

Report No.(s): TD98-0284; TM-98-A069; Copyright; Avail: Issuing Activity

The potential benefits of a three-dimensional (3D) auditory display in enhancing the spatial situation awareness (SA) of a pilot were investigated in a flight simulation experiment. The study was aimed at the application of 3D audio in the cockpit of civil aircraft. Participants were required to follow a specific route that was presented on a map display. This display also contained information pertaining to that route. Primary flight information was available on another visual display. to increase the task load during a flight, the participants had to perform a secondary cognitive task now and then. This task required the participants to respond to target letters that were presented either visually or orally. to assess the spatial SA of the participants, the simulation was stopped on two occasions during a single flight run by blanking the outside imagery and all displays in the cockpit. Subsequently, a questionnaire was presented to the participants on one of the visual displays with three different sets of questions, regarding knowledge about elements in the environment and elements of the flight task. In the experiment, 3D audio was used to present spatial information about the environment and specific elements of the route. The auditory messages were presented in clusters of four with 40 s between the start of each cluster. In half of the experimental flight runs, 3D audio was available to the participants. SA-performance was measured by the response times to the questions and the accuracy of the answers. It was hypothesized that the use of 3D audio would result in a better SA of the participants, because 3D audio contains spatial information. Results showed no effects of 3D audio on spatial SA. The only significant effects of 3D audio were related to the performance on the secondary cognitive task, with worst performance on the visual secondary task and when 3D audio was present. Based on these results, it is hypothesized that the participants preferred to use the visual displays instead of the 3D audio messages to acquire the needed spatial information for answering the SA-questions. This preference may be due to limitations in the level of integration with 3D audio, because the 3D audio messages were presented sequentially. Also, constraints in the availability and accessibility of the 3D audio messages in the present experimental setup, may have biased the participants to use the visual displays.

Author

Auditory Signals; Display Devices; Flight Simulation; Three Dimensional Models; Human Factors Engineering; Aircraft Pilots; Spatial Dependencies

20000041707 British Airways Safety Services, London, UK

Situational Awareness: Has EFIS Delivered?

OLEary, Mike, British Airways Safety Services, UK; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 9.1 - 9.6; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical

Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

This paper considers whether the introduction into the flight deck of modern digital technology has been beneficial to the level of flight crew situation awareness. Modern technology has dramatically changed the way aircraft are operated. Much of the physical work has now been eliminated, theoretically allowing the flight crew more time for higher level planning and supervisory activities. However, accidents caused by situation awareness failures have not gone away as a consequence. Accident and serious incident rate statistics suggest that these have been fairly stable over the last decade during which time more and more of the latest generation of aircraft have been brought into operation. Incidents of a less serious nature also occur but are normally less frequently catalogued and categorized as less effort is applied to these cases than is the norm for their more serious brothers. Data from the British Airways Human Factors reporting programme is presented here indicating that modern technology does not necessarily augment situation awareness. The author suggests that the reduced requirement for both physical and cognitive data gathering activity on the flight deck may be partly responsible. Alleviation of this may require changes to both training and operating procedures.

Author

Cognition; Human Factors Engineering; Stability; Technology Assessment; Flight Safety

20000041708 Thomson-CSF Sextant, Meudon-la-Forêt, France

Situational Awareness on the Flight Deck Current Solutions Contributions: HFDS(R), FMS, GCAS/TAWS

Adams, Hal E., Thomson-CSF Sextant, France; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 8.1 - 8-5; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Controlled Flight Into Terrain (CFIT) remains as the primary contributor to the aircraft accident rate. The aviation industry has taken the challenge to reduce the fatal aircraft accident rate by 80% by the year 2000. Development of functionality that is designed to reduce CFIT accidents is an evolutionary, continuous process. The evolutionary process involves the interaction of diverse interests such as infrastructure, funding, cost, timing, safety, intellectual rights protection, technology, resources, etc. Imaginative, revolutionary CFIT solutions are restrained by interest interaction and by how expensive or technically challenging the solution. However, the change rate of the solutions process is tempered by public sensitivity. Currently there are available three avionics elements that contribute to improving the CFIT situation but are not widely utilized as an integrated solution. These three key elements are Heads Up Flight Display System (HFDSO), advanced Flight Management System (FMS) and Ground Collision Avoidance System (GCAS Terrain Awareness & Warning System/ TAWS). These elements are evolving and being constantly refined. The expectation of HFDS 0 is that the flight crew can operate in instrument meteorological conditions as if they are operating in visual meteorological conditions. This allows coupling of the external environment with awareness of aircraft state within bounded parameters. The expectation of advanced FMS is that the flight crew can operate in a non-FANS (Future Air Navigation System) as if they were operating in a FANS environment. This allows for use of tactical "FANS tools" to manage the flight deck tasks more efficiently. The expectation of GCAS/TAWS is that terrain can be made "visible" to the flight deck when the terrain is not physically or mentally "visible." This allows the inclusion of unrecognized, potentially and, or actually hazardous operations as part of the flight deck decision process. Revolutionary CFIT solutions are apparently required but it will require more awareness and drive by industry for revolutionary solutions to be employed.

Author

Flight Control; Terrain; Warning Systems; Safety Devices; Flight Management Systems; Display Devices; Aircraft Accidents

20000041709 Airbus Industrie, Toulouse, France

New Approaches Towards Maintaining Situational Awareness: The Contribution of a Fatigue Countermeasures Interface Speyer, J.-J., Airbus Industrie, France; Elsey, A., Page Aerospace, UK; Cabon, P., Paris V Univ., France; Mollard, R., Paris V Univ., France; Bourgeois-Bougrine, S., Paris V Univ., France; Parriaux, N., Pharos; Perrinet, M., Pharos; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 7.1 - 7.6; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

This paper reviews the specification and evaluation of a support system aimed at monitoring the vigilance and alertness of aircrews subject to sleep pressure. Visual and audio alert warnings timely inform the pilot of any reductions in vigilance hence inducing planned naps to alleviate sleep pressure. Aircrew fatigue during long-haul flights is recognised as one of the major constraints that can impair performance and situational awareness. Using physiological recordings on 156 flights, previous work has shown that reductions in alertness are frequent during flights, including the descent phase. Most decreases in alertness occur during the monotonous part of the cruise and were often observed simultaneously on both pilots in two person crews. Based on

these results specific operational recommendations have been designed. Further studies have shown the positive effects of these recommendations. These recommendations were gathered into a booklet for the use of long-haul aircrews. Currently, this booklet is available in French, English and Chinese. One of the main recommendations promoted in these guidelines is based on the alternation of crew rest and activities, including cockpit napping. The efficiency of cockpit napping was first emphasised by Graeber et al (1990). However, one of the main drawbacks of cockpit napping is that it could contribute to increase the monotony inside the cockpit (reduced communications, lower light intensity ...) and thus could decrease the alertness and awareness of the other pilot remaining at the controls. Therefore fail-safe monitoring of the non-napping pilot should avoid simultaneous sleepiness of the two pilots. The Electronic Pilot Activity and Alertness Monitor (EPAM) is intended to provide this support.

Derived from text

Alertness; Fatigue (Materials); Specifications; Evaluation; Support Systems; Warning Systems

20000041710 Honeywell, Inc., Airline Avionics, Redmond, WA USA

Flight Safety Improvements Through Advanced Avionics Solutions

Carman, Mike, Honeywell, Inc., USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 6.1 - 6.6; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

There has been continuous improvement in the effectiveness of individual flight safety-related systems. Originally, these systems did not communicate with each other; more recently there has been a trend for systems to be coordinated (e.g. prioritization of alert messages). In the future, to gain the benefits of improved performance and reduced cost, the trend will continue towards complete functional integration of these systems.

Author

Flight Safety; Technology Assessment; Functional Integration; Communication

20000041711 Smiths Industries Aerospace and Defence Systems Ltd., Cheltenham, UK

Free Flight Operational Scenarios

Leeson, Michael J., Smiths Industries Aerospace and Defence Systems Ltd., UK; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 5.1 - 5.4; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Any movement towards a free flight operational scenario will introduce more information onto the flight deck and generate a higher workload for the crew. Unless this increase is managed, it will compromise the safety of the aircraft and reduce the likelihood that this new technology will be accepted. This paper introduces the concept of free flight and the new roles of the crew in future free flight environments. The impact of these changing roles and evolving scenarios on the demand for situational awareness is discussed within the framework of a probable future operational scenario.

Author

Free Flight; Safety; Technological Forecasting

20000041712 Airbus Industrie, Toulouse, France

Integration of Situational Awareness on Airbus Flight Decks

Wainwright, William, Airbus Industrie, France; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 4.1 - 4.9; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

The need for situational awareness is not new, but enormous progress has been made since the introduction of the first real "glass cockpit" aircraft - the A320. Where we have been able to improve situational awareness is in giving the pilot an uncluttered cockpit, with an unobstructed view of his primary displays, where all the information needed is concentrated directly in front of his eyes. Situational awareness includes awareness in the horizontal & vertical planes, as well as awareness of energy. I will describe the history of situational awareness in Airbus Flight Decks up to & including the introduction of EGPWS (Enhanced

Ground Proximity System). I will then discuss the near future with the "Peaks" display & vertical cut, & how awareness of energy is treated at Airbus is discussed. Finally, our method for ensuring a good Human/Machine interface & future technological advances, including navigation on the ground is discussed.

Author

Cockpits; Display Devices; Field of View

20000041713 Rockwell Collins, Inc., Cedar Rapids, IA USA

Situational Awareness: A Systems Approach

Heinrich, Richard E., Rockwell Collins, Inc., USA; Castelberry, Daniel, Rockwell Collins, Inc., USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 3.1 - 3.10; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Improved situational awareness on the flight deck relies on many information sources. These sources are part of an ever-expanding set of sensors and database inputs that must be managed. It is the intent of this paper to explore the various data types and illustrate how a systems perspective is intended to help support information management.

Author

Information Management; Information Systems; Support Systems

20000041714 Boeing Co., Seattle, WA USA

Vertical Situation Awareness Display

Jacobsen, Alan R., Boeing Co., USA; Chen, Sherwin S., Boeing Co., USA; Wiedemann, John, Boeing Co., USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 2.1 - 2.8; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Of the more than 200 heavy air transport accidents involving hull loss and/or fatalities over the last 10 years, more than 50% have been associated with either Controlled Flight Into Terrain (CFIT) or the Approach and Landing phases of flight. A large portion of these accidents have resulted from inadequate or loss of vertical situation awareness on the part of the flight crew. Over the past several years, various types of interventions have been investigated in an attempt to address this issue on the flight deck. While many new, and often high-priced, technology items promise to deliver improved situation awareness, cost effective solutions that are relatively easy to retro-fit must be found to significantly enhance safety in the world-wide fleet. Presenting flight crews with a side looking profile of the vertical dimension is one such solution. While not the final answer to overall situation awareness, the vertical situation display (VSD) has been shown to be an effective format for significantly enhanced vertical awareness on the part of the flight crew and can be implemented into today's flight decks in a cost effective manner. It is expected that this type of display concept can significantly reduce the accident rate over the next 5 to 10 years. The VSD complements and enhances the overall effectiveness of other systems like the Terrain Avoidance Warning System. By allowing flight crews to more easily acquire and maintain a stable flight path the VSD also yields other benefits such as decreased occurrences of landing incidents and missed approaches.

Author

Terrain Analysis; Safety; Losses; Landing; Flight Control; Cost Effectiveness; Air Transportation; Accident Prevention

20000041722 British Aerospace Aircraft Group Systems North America, Rockville, MD USA

Enhancing Situational Awareness in the Civil Aircraft Cockpit

Tucker, Brian G. S., British Aerospace Aircraft Group Systems North America, USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 1.1 - 1.33; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Contents include the following: impact of increased traffic; the advantages of visual guidance systems (VGS); controlled flight into terrain-statistics; runway inclusion; and future benefits of VGS.

CASI

Cockpits; Flight Control

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20000034035 Norwegian Defence Research Establishment, Kjeller, Norway

Penetration Analyses of Protective Suits and Boots Against Jet Fuel (JP-8)

Pedersen, Bjorn, Norwegian Defence Research Establishment, Norway; Jan. 31, 2000; 22p; In English; Original contains color illustrations

Contract(s)/Grant(s): FFIBM/Oppdr Proj. 311501/138

Report No.(s): FFI/RAPPORT-2000/00660; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Penetration analyses with jet fuel have been carried out on three different protective suits and one pair of protective boots. The analyses were performed with a single cell permeation system developed at Norwegian Defence Research Establishment, Division for Protection and Materiel (FFIBM). A permeation rate of 1 microgram/(cm squared min) was used as breakthrough limit in these analyses. The analyses showed that the protective suits had limited protection against jet fuel based on our test criteria. The protective boots showed better protection properties.

Author

JP-8 Jet Fuel; Penetration; Protective Clothing; Boots (Footwear)

20000034079 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

The Human-Electronic Crew: The Right Stuff? Proceedings of the 4th Joint GAF/RAF/USAF Workshop on Human-Computer Teamwork

Reising, John; Taylor, Robert; Onken, Reiner; Dec. 1999; 226p; In English

Contract(s)/Grant(s): Proj-2403

Report No.(s): AD-A373926; AFRL-HE-WP-TR-1999-023; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The components integral to the operation of an Electronic Crew member (EC) have started to take shape. Questions have been raised as to the nature of the EC when finished. What are the key components that will ensure a successful emergence of this new technology? How can we plan for their development and incorporate the software and hardware elements to function in concert with one another. The purpose of this workshop was to examine these concerns. The key questions to be addressed were: (1) What are the core qualities that the Electronic Crew member must possess? (2) How does one estimate the amount of software code involved? (3) What are the key software modules? (4) What is necessary to ensure the modules function symbiotically? (5) What is sufficient functionality within the Electronic Crew member to satisfy the human operator requirements?

DTIC

Conferences; Cockpits; Human Factors Engineering; Human-Computer Interface; Aircraft Pilots

20000034183 San Jose State Univ., CA USA

Modifying the Human-Machine Interface Based on Quantitative Measurements of the Level of Awareness *Final Report, 1 Jun. 1998 - 30 Nov. 1999*

Freund, Louis E., San Jose State Univ., USA; Knapp, Benjamin, San Jose State Univ., USA; Nov. 30, 1999; 1p; In English

Contract(s)/Grant(s): NAG2-1223; No Copyright; Avail: Issuing Activity; Abstract Only

This project got underway without funding approved during the summer of 1998. The initial project steps were to identify previously published work in the fields of error classification systems, physiological measurements of awareness, and related topics. This agenda was modified at the request of NASA Ames in August, 1998 to include supporting the new Cargo Air Association (CAA) evaluation of the Human Factors related to the ADS-B technology. Additional funding was promised to fully support both efforts. Work on library research ended in the late Fall, 1998 when the SJSU project directors were informed that NASA would not be adding to the initial funding of the research project as had been initially committed. However, NASA did provide additional funding for the CAA project activity. NASA elected to leave the research grant in place to provide a pathway for the CAA project funding to SJSU (San Jose State University) to support Dr. Freund's work on the CAA tasks. Dr. Knapp essentially terminated his involvement with the project at this time.

Author

Human Factors Engineering; Human-Computer Interface; Physiological Effects; Revisions

20000037836 Boeing Co., Mesa, AZ USA

Test and Evaluation of the Man-Machine Interface Between the Apache Longbow(tm) and an Unmanned Aerial Vehicle
Kraay, Anthony G., Boeing Co., USA; Pouliot, Michelle L., Boeing Co., USA; Wallace, William J., Boeing Co., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B14-1 - B14-7; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The Boeing Company is studying a concept that involves teaming a manned rotorcraft, the Apache Longbow, with a unmanned air vehicle (UAV). During 1997 Boeing developed a preliminary man-machine interface between the Apache Longbow and an unmanned air vehicle. An early assessment of the man-machine interface in a virtual simulation environment was conducted. The study concentrated on the effects of crew workload during manned- unmanned teaming operations and acceptability of the design in terms of presentation of the data, functionality, and utility. A limited assessment of operational measures of effectiveness was also conducted. Subject pilots were satisfied with the man-machine interface, did not experience task overload and were able to perform UAV control tasks. Subjects did experience some difficulty with target acquisition and tracking, however. Initial data suggests that the potential exists to detect targets beyond the organic sensor range of current attack/reconnaissance rotorcraft without being exposed to threat detection.

Author

Pilotless Aircraft; Rotary Wing Aircraft; Man Machine Systems; Human-Computer Interface

20000038215 Institute for Human Factors TNO, Soesterberg, Netherlands

Heat Strain in NBC-Protective Suits *Warmtebelasting in NBC-Pakken*

denHartog, E. A., Institute for Human Factors TNO, Netherlands; Wammes, L. J. A., Institute for Human Factors TNO, Netherlands; Dec. 21, 1998; 23p; In English

Contract(s)/Grant(s): A98/KL/356; TNO Proj. 789.2

Report No.(s): TD98-0287; TM-98-A072; Copyright; Avail: Issuing Activity

It has been found that the NBC-protective suits currently in use by the Netherlands Armed Forces (M82), are not suitable for warm climates. The heat strain for the wearer is too high and the body temperature rises quickly. A new NBC-protective suit 'Out of Area' is available, of which the fabric has a higher air permeability, with maintenance of protection. This may result in an improved ventilation under the suit and, as a consequence, a lower vapour resistance. The improved ventilation should cause a considerable decrease in the heat strain of the wearer, because of the increased possibility to evaporate his sweat. In a previous study it was shown that an NBC-protective suit with an increased air-permeability has a lower vapour resistance. However, in experiments at 36 C we found no significant differences in heat strain for the wearer. This may have been due to the relatively low heat strain that was imposed in those experiments. Therefore, the experiments were repeated in a climate of 40 C, with a relative humidity of 20%. Together with the currently used (M82) suit and the new 'Out of Area' (OoA) suit, another configuration was also compared (PYJ). In this configuration the NBC-protection is worn as an undergarment with a combat suit on top of it. The 7 subjects had to walk on a horizontal treadmill for 90 minutes at a speed of 1.4 m/s, in a wind of 5 m/s. All three suits were worn in different sessions, each session was performed on a different day. In agreement with previous studies we found significantly larger mass loss in the OoA suit (732 g/hr) compared with the current M82 suit (670 g/hr, $p = 0.03$). Both suits (M82 and OoA) were not significantly different from the NBC-pyjamas (PYJ, 692 g/hr). Therefore, the heat loss by evaporation was also significantly larger in the OoA suit (494W) than in the M82 suit (452W), and both did not differ from the PYJ-suit (467W). However, this increased heat loss was counteracted by the increased "dry" heat gain in the OoA suit (157W) versus the M82 suit (93W) and the PYJ suit (92W). The net result was that there were no significant differences between all three suits for the physiological parameters: skin temperature, rectal temperature, heart rate and oxygen consumption and thus for metabolism. The difference in efficiency of sweat evaporation, which is the ratio (in %) of evaporated sweat to produced sweat, was significant between the NBC-undergarment (PYJ) and the current M82 suit (93% vs. 86%, $p = 0.02$), but not significantly different in the OoA-suit (91 %) compared to both other suits (OoA vs. M82, $p = 0.10$; OoA vs. PYJ, $p = 0.64$). For the subjective scores there was no difference in temperature and comfort. For the subjective score on humidity there was only a significant difference between the current M82 and the new OoA suit. At air temperatures, higher than skin temperature, the heat stress in the new 'Out of Area' NBC-protective suit is not significantly decreased compared to the current suit. The currently obtained increase in evaporative heat loss in the new Out of Area suit is counteracted by the increase in dry heat gain. Under conditions with lower air temperatures (lower than 33 C) there is probably a benefit in the use of NBC-protective clothing with a higher air-permeability. In hotter climates personal cooling systems may lead to a better balance between protection and heat stress. The configuration in which the

NBC-protection is worn as an under garment (PYJ) was also not significantly different in heat strain from both other suits and was in this aspect equivalent to the M82 suit.

Author

Protective Clothing; Body Temperature; Comfort; Cooling Systems; Dry Heat; Evaporation; Heat Tolerance; Physiology; Ventilation

20000038222 Institute for Human Factors TNO, Soesterberg, Netherlands

The Role of Stereo Vision in Driving Armored Vehicles in Rough Terrain Final Report De Rol van Stereo-Zien bij het Besturen van Pantservoertuigen in ruw Terrein

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; vanWinsum, W., Institute for Human Factors TNO, Netherlands; Feb. 22, 1999; 26p; In English

Contract(s)/Grant(s): A98/KL/375; TNO Proj. 788.1

Report No.(s): TD-99-0019; TM-99-A016; Copyright; Avail: Issuing Activity

Under contract of the Royal Netherlands Army, a study was conducted after the role of stereo vision in driving armored vehicles in rough terrain. This knowledge is essential in the formulation of design criteria of viewing systems for driving vehicles under armour and controlling Unmanned Ground Vehicles (UGVs). The study consisted of two parts. The first part is a literature review of the mechanisms involved in stereo vision and the role of stereo vision in general. The second part was a field experiment in which participants drove an armored vehicle through rough terrain in different viewing conditions. The hypothesis is that the role of stereo vision increases when the quality of other visual depth cues decreases. Although the literature reports no studies that can be applied to the current situation directly, there are suggestions for the role of stereo vision, e.g. it enhances the judgement of time to contact and the perception of terrain features. The field experiment shows that stereo vision can improve driving performance, and make the driving task less difficult. Furthermore, cues are found that the positive effect of stereo vision increases under degraded visual circumstances. Because the results of the literature review and the field experiment both suggest that stereo vision may improve driving performance, it is recommended to implement a viewing system that provides the driver with stereoscopic depth cues, e.g. a head coupled camera-monitor system. Human factors issues involved in the successful application of such a system include the field size of the instantaneous field of view, the magnification factor, the spatial resolution, and the minimal rotational speed and acceleration of the system.

Author

Stereoscopic Vision; Research; Design Analysis; Visual Stimuli; Viewing; Cameras; Armor; Military Vehicles

20000038777 Institute for Human Factors TNO, Soesterberg, Netherlands

Use of Adaptable Displays for Fighter Aircraft Flight Support Final Report Gebruik van Aanpasbare Displays met Gezichtspunt ter Ondersteuning van Vliegtaken in Gevechtsvliegtuigen

deVries, S. C., Institute for Human Factors TNO, Netherlands; Veltman, J. A., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Feb. 02, 1999; 46p; In English; Original contains color illustrations

Contract(s)/Grant(s): A95/KLu/341; TNO Proj. 788.1

Report No.(s): TD-99-0013; TM-99-A011; Copyright; Avail: Issuing Activity

In a flight simulator experiment pilots were subjected to a large range of tasks, namely waypoint flying, interception of intruders, threat zone detection and object localization. The set of tasks was chosen to cover all aspects of local and global navigation. The pilots were aided in their task by displays providing them with the necessary information. Goal of the research was to determine which type of display is optimal for which task and whether pilots choose the most optimal display when given a choice of displays. Five types of displays were used: a 2D north-up display, a 2D north/south-up display, a 2D heading-up display, a 3D egocentric display and a 3D exocentric (wigman) display. The experimental conditions allowed the pilots either the full choice of all display types, a choice of display types one and four only, display type one only or display type four only. The results show that for global navigation tasks (object localization) the use of the 2D north-up display leads to a significantly better performance than the use of the 3D egocentric display while the variable display conditions show intermediate results. Local guidance tasks are best served with the 3D egocentric display and worst with the 2D north-up display. Again, the use of variable displays yields intermediate results. A remarkable finding is that most pilots rarely adjusted their displays to the flight phase they were in. Apparently, a preference for a certain display is quickly adopted. This behaviour is probably sub-optimal and attention should be paid to this whenever a multiple-representation display like the one tested here will be implemented in an actual fighter aircraft. Worrisome was the finding that when using the five-choices option the number of crashes increased threefold. Though this effect was not significant, the sheer size calls for further research.

Author

Detection; Display Devices; Flight Simulators

20000039303 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA

Ground Reaction Forces in 1G and Simulated Zero-Gravity Running

McCrory, Jean L., Pennsylvania State Univ., USA; Derr, Janice, Pennsylvania State Univ., USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1996]; 2p; In English

Contract(s)/Grant(s): NAGW-4421; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research compared ground reaction forces during overground (1G) running and zero-gravity ty (0G) simulated treadmill running at a full body weight load in two restraint harness designs.

Author

Loads (Forces); Running; Biological Effects; Harnesses

20000039304 Pennsylvania State Univ., Center for Locomotion, University Park, PA USA

The Implications of Reduced Ground Reaction Forces During Space Flight for Bone Strains

Peterman, Marc M., Pennsylvania State Univ., USA; Hamel, Andrew J., Pennsylvania State Univ., USA; Sharkey, Neil A., Pennsylvania State Univ., USA; Piazza, Stephen J., Pennsylvania State Univ., USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1998]; 2p; In English

Contract(s)/Grant(s): NAGW-4421; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The specific mechanisms regulating bone mass are not known, but most investigators agree that bone maintenance is largely dependent upon mechanical demand and the resultant local bone strains. During space flight, bone loss such as that reported by LeBlanc et al. may result from failure to effectively load the skeleton and generate sufficient localized bone strains. In microgravity, a gravity replacement system can be used to tether an exercising subject to a treadmill. It follows that the ability to prevent bone loss is critically dependent upon the external ground reaction forces (GRFs) and skeletal loads imparted by the tethering system. to our knowledge, the loads during orbital flight have been measured only once (on STS 81). Based on these data and data from ground based experiments, it appears likely that interventions designed to prevent bone loss in micro-gravity generate GRFs substantially less than body weight. It is unknown to what degree reductions in external GRFs will affect internal bone strain and thus the bone maintenance response. to better predict the efficacy of treadmill exercise in micro-gravity we used a unique cadaver model to measure localized bone strains under conditions representative of those that might be produced by a gravity replacement system in space.

Author

Bone Demineralization; Loads (Forces); Musculoskeletal System; Treadmills; Countermeasures

20000039305 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA

Exercise Countermeasures for Bone Loss During Space Flight: A Method for the Study of Ground Reaction Forces and Their Implications for Bone Strain

Peterman, M., Pennsylvania State Univ., USA; McCrory, J. L., Pennsylvania State Univ., USA; Sharkey, N. A., Pennsylvania State Univ., USA; Piazza, S., Pennsylvania State Univ., USA; Cavanagh, P. R., Pennsylvania State Univ., USA; [1999]; 4p; In English; 1st; Space Biomedical Investigators', 11-13 Jan. 1999, League City, TX, USA; Sponsored by NASA, USA

Contract(s)/Grant(s): NAGW-4421; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The human zero-gravity locomotion simulator and the cadaver simulator offer a powerful combination for the study of the implications of exercise for maintaining bone quality during space flight. Such studies, when compared with controlled in-flight exercise programs, could help in the identification of a strain threshold for the prevention of bone loss during space flight.

Derived from text

Countermeasures; Physical Exercise; Bone Demineralization; Physiological Effects; Weightlessness; Biological Effects; Feet (Anatomy)

20000039307 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA

The Biomechanics of Exercise Countermeasures *Final Report*

Cavanagh, Peter R., Pennsylvania State Univ., USA; Sharkey, Neil, Pennsylvania State Univ., USA; Wu, Ge, Pennsylvania State Univ., USA; [1999]; 7p; In English

Contract(s)/Grant(s): NAGW-4421; NAG5-6199; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Penn State Zero-gravity Simulator (PSZS) is a device developed by the Center for Locomotion Studies (CELOS) to enable ground studies of exercise countermeasures for the bone loss that has been shown to occur during long-term exposure to zero gravity (0G). The PSZS simulates 0G exercise by providing a suspension system that holds an individual in a horizontal (supine) position above the floor in order to enable exercise on a wall-mounted treadmill. Due to this orientation, exercise performed in the PSZS is free of the force of -ravity in the direction that would normally contribute to ground reaction forces. In

order for movements to be more similar to those in OG, a constant force suspension of each segment (equal to the segment weight) is provided regardless of limb position. During the preliminary development of the PSZS, CELOS researchers also designed an optional gravity-replacement simulation feature for the PSZS. This feature was a prototype tethering system that consisted of a spring tension system to pull an exercising individual toward the treadmill. The immediate application of the tethering system was to be the provision of gravity-replacement loading so that exercise in OG- and 1G-loading conditions could be compared, and the PSZS could then be used to evaluate exercise countermeasures for bone loss during space flight. This tethering system would also be a model for the further refinement of gravity-replacement systems provided for astronaut usage while performing prescribed exercise countermeasures for bone loss during long-term space flights.

Author

Physical Exercise; Simulation; Simulators; Treadmills; Weightlessness; Biodynamics; Countermeasures

20000039308 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA

Subject Load-Harness Interaction During Zero-Gravity Treadmill Exercise

McCrory, Jean L., Pennsylvania State Univ., USA; Baron, Heidi A., Pennsylvania State Univ., USA; Derr, Janice A., Pennsylvania State Univ., USA; Davis, Brian L., Cleveland Clinic Foundation, USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1996]; 2p; In English

Contract(s)/Grant(s): NAGW-4421; Copyright; Avail: Issuing Activity

When astronauts exercise on orbit, a subject load device (SLD) must be used to return the subject back to the supporting surface. The load in the SLD needs to be transferred the body by a harness which typically distributes this load between the pelvis and We shoulders. Through the use of a zero-gravity simulator, this research compared subject comfort and ground reaction forces during treadmill running at three levels of subject load (60%,80%, and 100% of body weight) in two harness designs ("shoulder only" and "waist "and shoulder ").

Author

Harnesses; Physical Exercise; Simulators; Treadmills; Weightlessness

20000039421 Institute for Human Factors TNO, Soesterberg, Netherlands

Human Factors Issues and Advanced Interface Design in Maritime Unmanned Aerial Vehicles: A Project Overview 1995-1998 Final Report Technisch Menskundige Aspecten en Innovatieve Voor Maritieme Onbemande Luchtvaartuigen : Een Projectoverzicht 1995-1998

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Jan. 25, 1999; 29p; In English

Contract(s)/Grant(s): A95/KM/372; TNO Proj. 788.1

Report No.(s): TD-99-0006; TM-99-A004; Copyright; Avail: Issuing Activity

This report presents an overview of the studies conducted for the Royal Netherlands Navy under contract A95/KM/372 on the human-machine interface for steering Maritime Unmanned Aerial Vehicles (MUAWS) and controlling their remote cameras. While manual control is preferable for specific tasks, the operator misses critical sensory information, such as proprioceptive feedback on camera viewing direction. Furthermore, the information on the remote environment which is presented, namely the payload images, is of degraded quality due to the restricted data-link. This may result in camera images with low temporal and spatial resolution, and a small field of view. The six studies performed mainly focussed on the negative effects of the degraded visual information (including low update rates, transmission delays and zoomed-in camera images), and the possibilities to compensate these effects by innovative human-machine interface design. An important point of departure was that the improvements did not result in additional claims on the data-link. The applied techniques included the use of graphical overlays, ecological interface design, head-coupled control, and prediction techniques. The results show that carefully designed human-machine interfaces are able to partially compensate specific image degradations. The studies also served as a contribution to NATO Project Group 35 (PG35). The current report includes an overview of the progress within this Project Group. PG35 activities resulted in the identification of near-term research areas, e.g. interoperability, combined MUAV/heli operations, and the MUAV tactical information display.

Author

Cameras; Human Factors Engineering; Pilotless Aircraft; Remote Control; Human-Computer Interface; Design Analysis

20000039422 Institute for Human Factors TNO, Soesterberg, Netherlands

Remotely Controlled Flying Aided by a Head-Slaved Camera and HMD: Effects of MMD Type, Vehicle References and Stereo *Interim Report Afstandsbestuurd Vliegen Ondersteund Door een Hoofdgekoppelde Camera en HMD: Effecten van HMD Type, Voertuigreferenties en Stereo*

deVries, S. C., Institute for Human Factors TNO, Netherlands; Padmos, P., Institute for Human Factors TNO, Netherlands; Dec. 14, 1998; 27p; In English

Contract(s)/Grant(s): B97-032; TNO Proj. 788.1

Report No.(s): TD-98-0282; TM-98-B016; Copyright; Avail: Issuing Activity

In the simulator experiment reported here we examined several parameters influencing the performance of the operator of a (simulated) Unmanned Aerial Vehicle (UAV). This operator was fitted with an HMD which showed images from the (virtual) camera onboard of the UAV. The camera was slaved to the operator's head so that the camera movements mimicked the head movements. We examined steering performance for two HMD types: the low-end, LCD-based Virtual IO i-glasses, and the high-end, CRT-based n-vision Datavisor. Additional parameters were the presence of vehicle references in the images as an indication of camera orientation and the presence of stereo and hyper-stereo (large baseline stereo). Performance with the n-vision HMD was considerably better than with the i-glasses HMD, a difference which could not be attributed solely to the difference in field-of-view. The presence of vehicle references led to a modest improvement in performance. Stereo and hyper-stereo did not improve performance for this particular task.

Author

Pilotless Aircraft; Head-Up Displays; Flight Simulators; Cameras; Human Factors Engineering; Remote Control

20000039760 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA

In-Shoe Force Measurements From Locomotion in Simulated Zero Gravity During Parabolic Flight

McCrory, Jean L., Pennsylvania State Univ., USA; Schwass, John P., Pennsylvania State Univ., USA; Connell, Richard B., Krug Life Sciences, Inc., USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1995]; 1p; In English

Contract(s)/Grant(s): NAG5-6199; No Copyright; Avail: Issuing Activity; Abstract Only

No effective countermeasure for space-induced bone loss has yet been identified. It has been hypothesized that an effective exercise regimen would elicit loads on the lower extremity which resemble those encountered on Earth. Although a treadmill has been used on shuttle flights, the loads to which the lower extremity was exposed have not yet been quantified. It is believed that these loads are much less than the loads experienced in 1G. The purpose of this study was to determine the magnitude of lower extremity loading during tethered treadmill exercise in a 0G environment.

Author

Physical Exercise; Treadmills; Weightlessness; Gravitational Physiology; Impact Loads

20000039762 NASA Johnson Space Center, Houston, TX USA

Evaluation of a Treadmill with Vibration Isolation and Stabilization (TVIS) for Use on the International Space Station

McCrory, Jean L., Pennsylvania State Univ., USA; Lemmon, David R., Pennsylvania State Univ., USA; Sommer, H. Joseph, Pennsylvania State Univ., USA; Prout, Brian, Pennsylvania State Univ., USA; Smith, Damon, Lockheed Martin Engineering and Sciences Co., USA; Korth, Deborah W., Wyle Labs., Inc., USA; Lucero, Javier, Wyle Labs., Inc., USA; Greenisen, Michael, NASA Johnson Space Center, USA; Moore, Jim, NASA Johnson Space Center, USA; Journal of Applied Biomechanics; 1999; Volume 15, pp. 292-302; In English; Copyright; Avail: Issuing Activity

A treadmill with vibration isolation and stabilization designed for the International Space Station (ISS) was evaluated during Shuttle mission STS-81. Three crew members ran and walked on the device, which floats freely in zero gravity. For the majority of the more than 2 hours of locomotion studied, the treadmill showed peak to peak linear and angular displacements of less than 2.5 cm and 2.5 deg, respectively. Vibration transmitted to the vehicle was within the microgravity allocation limits that are defined for the ISS. Refinements to the treadmill and harness system are discussed. This approach to treadmill design offers the possibility of generating 1G-like loads on the lower extremities while preserving the microgravity environment of the ISS for structural safety and vibration free experimental conditions.

Author

Microgravity; Treadmills; Vibration Isolators; Kinematics; Astronaut Locomotion

20000039763 Pennsylvania State Univ., University Park, PA USA

Clues to Better Space Exercise: Faking Weightlessness

Health and Human Development News; 1992; Volume 6, No. 1, pp. 1 and 13; In English; Copyright; Avail: Issuing Activity

Of all the adverse effects that zero gravity has on the body, especially during long space flights, calcium loss may threaten astronauts' health the most. Studies suggest that the way shuttle astronauts exercise in space now may not be as helpful for slowing calcium loss as it could be. As part of a study on space exercise, the researchers developed a weightlessness simulator. The simulator consists of a treadmill mounted to a wall, in a manner that the subject is running horizontally to the wall. The subject is suspended horizontally to the floor by a series of cords. The simulator is designed to emulate the exercise desired in the microgravity of space. The goal of study using the Penn State Zero Gravity Locomotion Simulator is to give enough stress to the bones required for the deposition of calcium.

CASI

Locomotion; Treadmills; Weightlessness; Physical Exercise; Bone Demineralization; Countermeasures; Exercise Physiology; Physiological Effects

20000039764 Pennsylvania State Univ., University Park, PA USA

Doing the Locomotion

Pacchioli, David, Pennsylvania State Univ., USA; Health and Human Development; [1997], pp. 15-19; In English; Copyright; Avail: Issuing Activity

This article describes the research being done in how people move, how they maintain balance, and how they learn to do this. The article also describes the work being done to design footwear for diabetics to assist in avoiding complications due to ulcerations in the feet caused by neuropathy a common side effect of diabetes. Other research in the ways people fall and recover is also reviewed.

CASI

Walking; Falling; Human Reactions; Human Body; Sensorimotor Performance; Feet (Anatomy); Limbs (Anatomy); Shoes

20000040789 NASA Johnson Space Center, Houston, TX USA

Thermal Insulation Performance of Textile Structures for Spacesuit Applications at Martian Pressure and Temperature
Orndoff, Evelynne, NASA Johnson Space Center, USA; Trevino, Luis A., NASA Johnson Space Center, USA; 2000; 13p; In English; 2nd; Safety and Protective Fabrics, 26-28 Apr. 2000, Arlington, VA, USA; Sponsored by Industrial Fabrics Association International

Contract(s)/Grant(s): RTOP 131-20-95; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Protection of astronauts from the extreme temperatures in the space environment has been provided in the past using multi-layer insulation in ultra-high vacuum environments of low earth orbit and the lunar surface. For planetary environments with residual gas atmospheres such as Mars with ambient pressures between 8 to 14 hPa (8 to 14 mbar), new protection techniques are required because of the dominating effect of the ambient gas on heat loss through the insulation. At Mars ambient pressure levels, the heat loss can be excessive at expected suit external temperatures of 172 K with state-of-the-art suit insulation, requiring an active heat source and its accompanying weight and volume penalties. Micro-fibers have been identified as one potential structure to reduce the heat losses, but existing fundamental data on fiber heat transfer at low pressure is lacking for integrated fabric structures. This baseline study presents insulation performance test data at different pressures and fabric loads for selected polyesters and aramids as a function of fiber density, fiber diameter, fabric density, and fabric construction. A set of trend data of thermal conductivity versus ambient pressure is presented for each fiber and fabric construction design to identify the design effects on thermal conductivity at various ambient pressures, and to select a fiber and fabric design for further development as a suit insulation. The trend data also shows the pressure level at which thermal conductivity approaches a minimum, below which no further improvement is possible for a given fiber and fabric design. The pressure levels and resulting thermal conductivities from the trend data can then be compared to the ambient pressure at a planetary surface, Mars for example, to determine if a particular fiber and fabric design has potential as a suit insulation.

Author

Aerospace Environments; Planetary Temperature; Space Suits; Thermal Insulation; Gas Pressure

20000041705 State Univ. of New York, Dept. of Mechanical Engineering, Binghamton, NY USA

Motion Cueing Algorithm Development: Initial Investigation and Redesign of the Algorithms

Telban, Robert J., State Univ. of New York, USA; Wu, Weimin, State Univ. of New York, USA; Cardullo, Frank M., State Univ. of New York, USA; March 2000; 286p; In English

Contract(s)/Grant(s): NAS1-20454; RTOP 992-30-11-01

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In this project four motion cueing algorithms were initially investigated. The classical algorithm generated results with large distortion and delay and low magnitude. The NASA adaptive algorithm proved to be well tuned with satisfactory performance,

while the UTIAS adaptive algorithm produced less desirable results. Modifications were made to the adaptive algorithms to reduce the magnitude of undesirable spikes. The optimal algorithm was found to have the potential for improved performance with further redesign. The center of simulator rotation was redefined. More terms were added to the cost function to enable more tuning flexibility. A new design approach using a FORTRAN/Matlab/Simulink setup was employed. A new semicircular canals model was incorporated in the algorithm. With these changes results show the optimal algorithm has some advantages over the NASA adaptive algorithm. Two general problems observed in the initial investigation required solutions. A nonlinear gain algorithm was developed that scales the aircraft inputs by a third-order polynomial, maximizing the motion cues while remaining within the operational limits of the motion system. A braking algorithm was developed to bring the simulator to a full stop at its motion limit and later release the brake to follow the cueing algorithm output.

Author

Algorithms; Cues; Motion Perception; Software Engineering; Motion Simulators; Human Factors Engineering

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EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.

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ATLAS of Microorganisms from Ancient Phosphorites of Khubsugul (Mongolia)

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A photographic atlas of scanning electron microscope (SEM) images of Cambrian (Tommotian) microfossils from the phosphorites of Khubsugul Mongolia is presented. SEM images of modern cyanobacteria and bacteria are provided for comparison. The importance of bacterial fossils and morphological biomarkers to astrobiology and the understanding of the origin of phosphorites is considered.

Author

Microorganisms; Mongolia; Scanning Electron Microscopy; Exobiology; Phosphates; Minerals; Paleontology

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